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Differences in Creativity Across Domains Between Students with Dyslexia and Those Without

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When a student has a learning disability in reading and or dyslexia, interventions focus on remediating the weakness. Positive psychology is a field of psychology that looks to help people, based on harnessing a person's strengths, to create better outcomes. Strengths-based or asset-based interventions have been used with people with developmental disabilities to learn new skills. This study hoped to help identify strengths for people with dyslexia in two areas that have been hypothesized to be strengths for them: creativity and visual-spatial ability. Creativity has typically been assessed with domain-general measures rather than actual measures of creativity. Similarly, visual-spatial ability has been measured with paper-and-pencil tests. Eide and Eide (2011) have suggested that students with dyslexia may be better able to demonstrate their strengths using real-world measures. The purpose of this study was to compare the performance of students with and without dyslexia using real-world products. More specifically, the goals were to see if they had different patterns of creative abilities; to assess in what areas they differed between groups; and, within the dyslexia group, to identify where their strengths lay. An additional question inquired about the difference between a psychometrically validated visual-spatial measure, and a real-world three-dimensional creative product. The two groups had different patterns of strengths and differed within the written domain; significant results were not found within the dyslexia group, and visual-spatial ability did not differ between group or domain; educational implications are discussed.

Keywords: Dyslexia, Creativity, Visual-Spatial Ability, Positive Psychology

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Differences in Creativity Across Domains

Between Students with Dyslexia and Those Without

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DEDICATION

To my mother, Eduwiges Linares, this dissertation is dedicated to you. You are my biggest role model and supporter. You have taught me to push through in the face of adversity and have faith in God that everything would work out. Through the years, I have realized how truly wise you are. Your advice is invaluable to me. I am grateful to not just call you my mother, but also my friend. Thank you for always believing in me and never letting me quit. I love you, your baby girl.

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CHAPTER I: INTRODUCTION

In 2015, 13% of all students in the United States were being served by the Individuals with Disabilities Education Act (IDEA) as a student with a disability (U.S. Department of Education, National Center for Education Statistics, 2018). Thirty-two percent of those served (2,278,000 students nationwide) were identified as a student with a Specific Learning Disability (SLD). IDEA defines an SLD as:

> A disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations, including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. A specific learning disability does not include learning problems that are primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage. (34 CFR § 300.8(c)(10]).

As mentioned, one such SLD identified by IDEA is Dyslexia, a reading disability that leads to struggles in learning how to decode and spell words (Lyon, Shaywitz & Shaywitz, 2003). If left untreated, it may contribute to academic underachievement and low self-esteem (Ross & Broh, 2000). Though effective, deficit-based interventions focus solely on remediating the reading difficulty. It is important to identify strengths for students with dyslexia, as research has shown that strength-based interventions have a powerful effect on students' growth (Raab, Dunst, & Hamby, 2016), although many disagree with this assertion (e.g., Fletcher & Miciak, 2017). It may also assist in increasing students' self-efficacy, which is predictive of academic achievement (Bong, Cho, Ahn, & Kim, 2012; see Figure 1).

Statement of the Problem

Although it is widely believed and hypothesized that visual-spatial ability is a strength for people with dyslexia, empirical research has generally found no difference between students with

dyslexia and controls (Gilger, Allen, & Castillo, 2016). Attree, Turner, and Cowell (2009) found a significant difference in a computer-generated virtual environment test and suggested that the strength may lie in real-life measures. In the realm of creativity, research has been inconsistent, and the measures used are domain-general and do not look at actual creative products. Also, creativity has been measured separately from visual-spatial ability; no study has used a three-dimensional measure of creativity. Like Attree et al. (2009), Eide and Eide (2011) indicated that students with dyslexia are more creative in realistic areas, suggesting it may be difficult to identify strengths using paper-and-pencil tests.

Purpose of the Study

The purpose of this study was to examine dyslexic students' visual-spatial creativity by examining actual three-dimensional products created by them. Students with and without dyslexia were asked to create a three-dimensional sculpture, out of clay, which was evaluated by qualified raters. This product was also compared to a two-dimensional drawing, a written description, and an oral narrative created by the same student to see how their strengths varied by domain. Additionally, the three-dimensional sculpture was compared to a psychometrically validated visual-spatial measure to identify if there was a difference between a real-world measure of visual-spatial creativity versus a two-dimensional assessment that is typically used to measure visual-spatial ability.

Research Questions

RQ1: Do students with dyslexia show a similar pattern as students without dyslexia in creative ability?

RQ2: Do students with dyslexia, as compared to their non-dyslexic peers, evidence more or less creativity in the areas of building, drawing, writing, or storytelling?

RQ3: In what specific domains are students with dyslexia most creative?

RQ4: Do three-dimensional creative products differ from a psychometric visual-spatial measure for students with dyslexia compared to their non-dyslexic peers?

CHAPTER II: REVIEW OF THE LITERATURE

Overview of Dyslexia

The International Dyslexia Association (2002) and the National Institute of Child Health and Human Development (NICHD) have adopted the following definition of dyslexia: "Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede the growth of vocabulary and background knowledge" (Lyon et al., 2003, p. 2).

The British Dyslexia Association (BDA) incorporates more of the cognitive aspects of dyslexia: "Dyslexia is a specific learning difficulty that mainly affects the development of literacy and language-related skills. It is likely to be present at birth and to be life-long in its effects. It is characterized by difficulties with phonological processing, rapid naming, working memory, processing speed, and the automatic development of skills that may not match up to an individual's other cognitive abilities" (BDA, 2007, line 29).

Fawcett and Nicolson (2007) indicate that knowing the cause of the symptoms will lead to better interventions. However, multiple studies have used multivariate predictive models (Le Jan et al., 2011) and exploratory factor analysis (Tamboer, Vorst, & Oort, 2016) to identify appropriate diagnostic assessment that distinguishes between the subtypes of dyslexia. Although researchers have been able to identify models with high predictive validity, students' symptoms vary so widely that they cannot be neatly categorized.

The above findings are consistent with Pennington's et al. (2012) findings. Rather than looking at students with dyslexia and analyzing their weaknesses as a group, Pennington et al. (2012) took a case study approach. They wanted to see if students fit into a single deficit model with an impact on phonological awareness, processing speed, naming speed, or language, or if it was a multiple deficit model, where students showed at least two deficits. They found a middle ground, a hybrid model in which some students showed a single deficit, and others had multiple deficits. Their study showed that although phonological awareness is the highest predictor of dyslexia, not all students with dyslexia have this deficit. In addition, not all students who struggle with phonological awareness have dyslexia. The authors suggest that the primary predictors of dyslexia (phonological awareness, processing speed, naming speed, and language) are just probabilistic variables and not deterministic.

Symptoms of dyslexia. As mentioned above, students with dyslexia are a heterogeneous group; not all have every symptom or the same combination of symptoms. The BDA definition includes cognitive deficits such as speed of processing, short-term memory, sequencing, auditory perception, and visual perception. Denckla and Rudel (1976) measured speed of rapid naming of colors, numbers, letters, and objects and found that students with dyslexia were not only slower than students without disabilities but also those with other learning disabilities. Studies have also found impaired areas of executive functioning. Smith-Spark and Fisk (2007) looked at different types of working memory in students with dyslexia. The authors found that students with dyslexia struggled in all areas of working memory, whether it was simple versus complex or visual versus verbal. Bosse, Tainturier, and Valdois (2007) found that visual attention span independently contributes to reading ability; in some cases, it is the primary reason for the difficulty instead of phonological awareness.

These cognitive deficits can affect academics in other ways than just decoding and spelling. Along with reading and spelling, students with dyslexia have secondary consequences in reading comprehension, reduced reading experience, lower vocabulary, and background knowledge (Lyon et al., 2003). Other academic areas that are affected include mathematics. Simmons and Singleton (2009) looked at the strengths and weaknesses of children with dyslexia and found that while students with dyslexia were not impaired in place value understanding, they were slower and less accurate in number fact recall than their non-dyslexic peers. Above all, students with dyslexia may struggle with learning that requires reading. As students get older, they go from learning to read to reading to learn. If a student is unable to read the material, it will be more challenging to learn it without reading supports.

Reading interventions. In the United States, the federal government identifies dyslexia as a type of specific learning disability (SLD; Individuals with Disabilities Education Act, 2004). As such, students with dyslexia receive special education services to help them succeed in school. This categorization leads to deficit-based interventions where the focus lies on students' weaknesses. These interventions have been instrumental in helping students learn how to read. Wajuihian and Naidoo (2012) indicated that remediation of reading, followed by accommodations that help manage the demands of school (providing extra time for reading, audiobooks, and the use of a spell checker) help students succeed in school. Without these supports, students with dyslexia may experience academic underachievement.

There are many well developed and scientifically proven reading interventions, as can be seen on the Institution of Educational Science's What Works Clearing House website. Many of the interventions focus on teaching students phonological awareness, phonics, fluency, and reading comprehension. The sooner interventions are implemented, the better the students'

improvements are (Grigorenko et al., 2019). In 2004 with the reauthorization of IDEA, Response to Intervention (RtI) gained momentum as a form of identifying students earlier, based on their response to scientifically validated interventions within different tiers. All students are screened and provided support based on their level of need (Little, 2018).

Although these programs may be effective at increasing a student's reading ability to working levels, they are time and resource-intensive and may not be able to close the gap completely. Though students may learn decoding mechanisms and appear to no longer have difficulty decoding, they may still be identified by slow and effortful reading (Gabrieli, 2009). Additionally, these interventions only focus on one aspect of the student, and while the student is spending all of their time learning to decode, they are not learning to use their strengths to help support their disability (i.e., strong listening comprehension skills, reasoning skills, verbal skills, or artistic abilities). Also, because the focus is based on what they cannot do, they may feel self-conscious about their reading ability or develop low self-esteem. The next section will focus on positive psychology and strength-based perspective.

Positive Psychology

Positive Psychology gained popularity in 1998 when Martin Seligman, American Psychological Association (APA) president at that time, challenged applied psychologists to not just focus on curing mental illness, but also to help make the lives of their clients more fulfilling by identifying and nurturing their talents (Magyar-Moe, Owens, & Conoley, 2015). Though it is considered to be a relatively new field of study, it has been around since 1908 when Beers published *A Mind that Found Itself.* He discussed the potential to recover from mental illness by using personal strengths that could aid in recovery. Positive psychologists do not view the client as someone who needs fixing, but rather someone with strengths that can be harnessed to create a

better outcome (Edwards, 2016). Positive psychology can also be used in behaviorism. Similar to how a learned helplessness response style can be developed when a student with academic struggles continues to fail, Seligman believed that "learned optimism" can also be achieved by learning "mental skills that would change one's view of life in a positive and self-directing fashion" (Hunt, 2007, p. 386).

Many positive psychology interventions have addressed mental health, specifically depression, anxiety, subjective well-being, and psychological well-being (Chakhssi, Kraiss, Sommers-Spijkerman, & Bohlmeijer, 2018; Hendriks, Schotanus-Dijkstra, Hassankhan, Jong, & Bohlmeijer, 2019). Olympia et al. (2013) describe how positive psychology principles have been used with children who have emotional and behavioral difficulties. They indicated that though this area typically focuses on psychopathology, excessive behavior, and skills deficits, new interest focuses on how these interventions fall within the realm of positive psychology. They explain that positive psychology takes a broader view when explaining behavior by considering overall strengths and abilities that help lead to happiness and subjective well-being. For example, some interventions for depression focus on developing a positive self-concept and helping the person focus on positive events that are happening in their life. Many prevention programs focus on building resiliency that may serve as protective factors in stressful situations. Similarly, interventions for children with externalizing behavior difficulties focus on positive reinforcement, increasing praise, using motivational systems for appropriate behavior, and setting family rules. A meta-analysis by Maughan, Christiansen, Jenson, Olympia, and Clark (2005) found a large effect size in reducing behaviors using these techniques.

As for autism, Zager (2013) indicated that there is an overlap between the field of positive psychology and autism: they both focus on individual interests, strengths, and potential.

Maximizing strengths and utilizing interests for people with autism helps build adaptive behaviors so they can have a better quality of life and meet personal goals. There are three popular interventions or models that align with positive psychology theory: applied behavior analysis (ABA), developmental, individual-difference, relationship-based model (DIR), and treatment and education of autistic and related communication handicapped children (TEACCH). In ABA, as children develop basic skills and become more able to deal with their environment, their positive behaviors emerge or increase. For DRI, interpersonal relationships are emphasized as key to skills acquisition. TEACCH uses students' strengths for successful task completion, which increases confidence and enhances motivation. These interventions are person-centered and attempt to build a consistent trusting relationship between the person, the therapist, and the environment.

An area where positive psychology has taken off is in the realm of cognitive and developmental disabilities (Shogren, 2013). A review of five prominent journals in the intellectual and developmental disability field from 1975 to 2004 showed a considerable increase (from 22% to 50%) in the articles that focus on strengths and positive psychology (Shogren, Wehmeyer, Pressgrove, & Lopez, 2006). A major focus has been on how disability is viewed: not as a deficit that resides within a person but, instead, as an interaction between the person's abilities and the demands of the environment. Shogren (2013) states that when using a strengths-based perspective when providing supports and services for people with disabilities, it is essential to not just look at functional limitations that define the disability, but also individualized supports, a person's well-being and quality of life, and personal competences and adaptations.

Strengths-based interventions. One of the core positive psychology theories is strength theory. This theory focuses on building one's strengths while managing weaknesses. Magyar-Moe et al. (2015) mentioned how people tend to focus on weaknesses and ignore strengths. She gave four reasons why this is an error in thinking. First, there is the idea that by fixing a weakness it will make the person stronger. However, by eliminating one's weakness, it only makes them average. Second, is the idea that one does not need to focus on strengths because they will develop on their own; however, strengths innate or not, still need to be nurtured and developed. If these talents are not developed, they may relax to an average skill. The third error is the belief that strengths and weaknesses are opposite when they could be close companions or trade-offs of particular traits. The final error is the misconception that anyone can do anything as long as they set their minds to it. With training and dedication, one may develop specific skills; however, true long-term success inherently involves one's unique set of strengths (Magyar-Moe et al., 2015).

Though many interventions align with positive psychology and focus on emotional health and subjective well-being, fewer positive psychology interventions have attempted to address skill acquisition for people with disabilities. A set of studies has looked at response contingent learning, which utilized asset-based versus needs-based interventions (e.g., Dunst, Raab, & Hamby, 2017; Raab et al., 2016). Raab et al. (2016) compared response-contingent learning delivered through an asset-based intervention versus a needs-based intervention for children with significant developmental delays and multiple disabilities. Learning games were identified by either, skills the child already possessed as building blocks for new behavior (asset-based), or delayed skills that needed to be taught for the new behavior (needs-based). The researchers

found that children in the asset-based group were provided more learning opportunities, acquired more response-contingent behavior, and learned more efficiently than the needs-based group.

Positive psychology in special education. Positive psychology has also been influential in education. Field (2013) indicates how, by definition, disability focuses on negative traits—something that a person is lacking or has a deficit in. However, there has been an increasing debate about how to educate students with disabilities: do students with disabilities need distinctive, specialized instruction that focuses on the area of need, or should they be educated within the typical education setting, with their peers, where supports are individualized at all levels of need? The difference between views depends on which model is being used: the medical, deficit-based model, or a more ecological model that focuses on the strengths-based approach.

Additionally, a focus on providing educational services that promote quality of life rather than just remediating deficits has developed. Self-determination has become especially important in special education, especially in transition planning from school to adulthood, helping students increase in self-reliance so that they may have better control over what they choose to do. In terms of assessment, Field (2013) states that it should be broader in focus, to assess varying levels of strengths and abilities in different contexts. Buntinx (2013) stresses that "It must be clear that emphasizing the importance of strengths and facilitators does by no means make diagnosis of health conditions, etiology, impairments, and limitations less important," (p. 15) and states that failure to identify relevant difficulties could result in ineffective supports.

Regarding positive psychology, previous strengths-based interventions with students with disabilities, and changes in the field of special education makes the author wonder if there is a way to create strengths-based interventions for students with dyslexia. Before designing an

intervention, strengths rather than weaknesses need to be identified within this particular population. Additionally, if specific strengths do exist, and are not developed, students may not know how to use them to their advantage. The rest of the literature review focuses on areas that have been hypothesized to be strengths for students with dyslexia.

Dyslexia and the Brain

Lateralization. As mentioned above, dyslexia is neurobiological in origin. In 1980, Gordon studied hemisphere dominance in children with dyslexia and their families. He gave them a variety of assessments that could either be considered right or left hemisphere. The left hemisphere subtests included serial sounds, circles tests, word production (fluency), digit span, and numbers. Right hemisphere subtests consisted of model orientation, form completion, and block design. Using these assessments, they were able to derive a Cognitive Laterality Quotient. Gordon found that not only did students with dyslexia have right hemisphere dominance, so did 90% of their immediate families.

More recently, Leonard and Eckert (2008) have used magnetic resonance imaging (MRI) to scan the brains of adults and children with dyslexia and identify the anatomical signatures that may aid in the classification of dyslexia. They found that people with dyslexia may possess either symmetry or asymmetry in the brain. Those with more symmetry tended to have more comprehension based deficits consistent with specific language impairments along with their phonological deficits. Those with more asymmetry between the temporal and parietal lobes tended to have the phonological deficits without the comprehension being affected. Anecdotal evidence from their studies showed that those with larger asymmetry due to a larger parietal lobe had successful careers in areas requiring visuospatial abilities.

Visual-spatial ability. Eide and Eide (2011) indicate that one of the advantages dyslexics possess is in spatial reasoning. They define it as "...abilities that help us reason about the physical or material world—that is, about the shape, size, motion, position, or orientation in space of physical objects, and the way those objects interact" (p. 49). Plenty of research has been conducted investigating this relationship, much of which will be discussed later under creativity, dyslexia, and visual-spatial ability. In this section, only research that does not include creativity will be discussed.

Cooper (2009) found that students with dyslexia had higher visual-spatial abilities compared to verbal abilities. He indicated that 91% of people were able to think verbally (could think about things without seeing them). However, when it came to problem-solving, 33% of students with dyslexia had to see the problem visually to solve it; this was much higher than the 5% of non-dyslexics who required to see the problem.

Gilger et al. (2016) reviewed the literature on spatial reasoning and reading disabilities due to the popular belief and anecdotal evidence of their relationship. They analyzed 21 studies with a total of 57 measure comparisons ranging from Mental Rotation, Gestalt Completion Test, Spatial Reasoning, and Block Patterns. Out of the 57 comparisons, students with dyslexia were higher than non-dyslexics six times. Ten of the times, students with dyslexia were significantly lower than students without dyslexia. In the remaining 41 cases, there was no difference between the groups. A general area where students were strongest was in reaction time, specifically in holistic visualization and complex figures (Brunswick, Martin, & Marzano, 2010; Von Károlyi, 2001; Von Károlyi, Winner, Gray, & Sherman., 2003).

Because of these inconsistent findings, Attree et al. (2009) wanted to look at visuospatial ability in a real-life context. They took 21 students with dyslexia and 21 controls and gave them

three visuospatial tasks, two of which were cognitive measures from the British Ability Scales 2nd Ed., and the third was a computer-generated virtual environment test. They found that the groups did not significantly differ from each other in the cognitive tasks, but students with dyslexia performed significantly better in the real-life version. Attree et al. suggest that students with dyslexia may have superior visual-spatial abilities when assessed with real-life tests rather than a pencil and paper test.

Creativity

Creativity measures. Creativity is traditionally defined as having two main components: being new or different and being task appropriate (J.C. Kaufman, 2016). There is much debate over how to best measure creativity. One of the most commonly used measures is the *Torrance Tests of Creative Thinking* (TTCT; Torrance, 1974, 2008). The TTCT measures divergent thinking, an aspect of creativity that is the ability to come up with as many ideas to open-ended questions as possible (Guilford, 1950). The TTCT has been translated into many languages and used around the world (J. C. Kaufman & Sternberg, 2006). There are two forms, Figural and Verbal. The Figural form includes tests of *Picture Construction, Picture Completion,* and *Lines/Circles.* The Verbal test includes subtests such as *Ask-and-Guess, Product Improvement, Unusual Uses,* and *Just Suppose*. Both forms are scored for three abilities: fluency, flexibility, and originality. Fluency is how many different responses the participants can generate, flexibility is how many different categories of responses were present, and originality is how statistically rare the responses were (Kim, 2011). The Figural test is scored for several additional other dimensions, including (most notably) elaboration, or the amount of detail in the responses (J.C. Kaufman, 2016; J. C. Kaufman, Plucker, & Baer, 2008).

Although the TTCT are the most common creativity assessments, they have several problems. One problem is that the tests measure one aspect of creativity (divergent thinking), and

some have argued that they lack real-world relevance (Baer, 2011). Another problem is that the tests assume domain-generality. In other words, they assume that creativity is one entity, and the format or domain of expression is less critical (Baer & Kaufman, 2017). In contrast, a domain-specificity approach assumes that creativity can be expressed in many different ways, from cooking to computer science to haikus to engineering to inventing (J. C. Kaufman, Glăveanu, & Baer, 2017). Ideally, a measure of creativity would tap into multiple domains (e.g., J. C. Kaufman, 2012).

Another measure is self-report or asking people to assess their creativity. This measure is often used because it is easy and inexpensive. However, people's self-ratings may not be related to their actual creative work (J. C. Kaufman, 2019; J. C. Kaufman, Evans, & Baer, 2010). People who are high in creative metacognition may give more accurate numbers, but people who are low on creative metacognition may give responses that are not useful (J. C. Kaufman & Beghetto, 2013).

A third type of measurement is the Consensual Assessment Technique (CAT; Amabile, 1982, 1996). The CAT has participants produce real-world products (stories, drawings, math equations) that are rated for creativity by expert raters. Expert raters are considered people with at least ten years of experience in either the domain being rated, the population being assessed, or in creativity in general. However, as J. C. Kaufman and Baer (2012) note, quasi-experts can also be very reliable. A quasi-expert is anyone who has some experience in the area being rated (Kaufman, Baer, Cropley, Reiter-Palmon, & Sinnett, 2013). During the rating process, products are compared only to each other and not to an ideal, and the raters do not communicate with each other during the rating process (Baer & Kaufman, 2019). The CAT has consistently shown high inter-rater reliability (Amabile, 1996; Baer, J. C. Kaufman, & Gentile, 2004), and the biggest

benefit is that the CAT uses real-life creative products and can be used for multiple domains. However, it requires large amounts of time and resources, which is one reason why it is less commonly used in large-scale projects (J. C. Kaufman & Baer, 2012).

Creativity and dyslexia. Dyslexia is mainly studied in regards to difficulty in reading, writing, and spelling (Eide & Eide, 2011). However, as researchers look to potential strengths that may be associated with dyslexia, one growing area is creativity (Everatt, Steffert, & Smythe, 1999; Gordon, 1980; Kapoula et al., 2016; N. L. Kaufman & Kaufman, 1980; Tafti, Hameedy, & Baghal, 2009). Some studies have shown that students with dyslexia tend to be more creative and or original than students without dyslexia (Everatt et al., 1999; Tafti et al., 2009). N. L. Kaufman and Kaufman (1980) compared 22 students with minimal brain dysfunction (MBD) and 22 controls on different aspects of creativity: fluency, flexibility, and originality. They found that students with MBDs were significantly more original than the control group. Tafti et al. (2009) found that students with dyslexia scored higher on the TTCT figural form than those without dyslexia. When looking at non-verbal problem-solving tasks and innovation, college students with dyslexia were more creative than non-dyslexic students (Everatt et al., 1999).

Cancer, Manzoli, and Antonietti (2016) used the WCR Creativity Test to see if there was a difference between students with dyslexia and controls in these creative abilities. This measure looks at three abilities: widening, a divergent thinking ability; connecting, identify relationships; and reorganizing, being able to re-contextualize things. Although they did not find a difference between groups in the area of widening, students with dyslexia scored higher on connecting than their junior-high peers. A follow-up study found that this construct was negatively related to reading ability, specifically, reading speed and accuracy.

Researchers have also found the opposite results. In a study of 26 students divided into two groups (dyslexia versus control), students were given the Child Figural Creativity Test (CFCT) a divergent thinking measure where students produced drawings based on poorly-defined and incomplete stimuli, and they were rated for 12 creative characteristics which included fluency, flexibility, elaboration, and originality. The researchers did not find any significant differences between the groups (Alves & Nakano, 2014)

Mourgues, Preiss, and Grigorenko (2014) examined creativity and its relation to reading ability and found that creativity was positively correlated with verbal ability across six creative tasks. These tasks consisted of two-dimensional and three-dimensional insight tasks in which participants had to restructure problems to solve them; verbal and figural divergent thinking tests, a compound word task in which participants remotely connected semantically distant words; and a rebus puzzle task in which participants identified a hidden message in an image. Reading ability was measured with General Rhyming, Word and Pseudo Homophone Decision, and Reading Comprehension subtests from various assessments batteries. These reading measures accounted for 7 to 19 percent of the variances in creativity using the adjusted r squared in a regression model. MANOVAs were also used to compare low achieving groups (1.3 SD below the mean) with high achieving groups (1.3 SD above the mean). These analyses also revealed significant differences between the two groups.

It is important to note that low verbal ability does not equate to dyslexia. Another language disability that affects reading is specific language impairment (SLI). Although students with SLIs and those with dyslexia may struggle with phonological awareness, the differentiation is made between word reading and decoding abilities versus listening comprehension. Students with dyslexia struggle with the former, while students with SLIs struggle with the latter (Catts,

Adlof, Hogan, & Weismer, 2005; Kim & Lombardino, 2013). Reading comprehension may be affected due to the inability to read words, but it is not an actual factor in Dyslexia.

Several reasons have been proposed for dyslexia's often positive relationship with creativity. Five possible reasons suggested by Wolff and Lundberg (2002) included that, first, the link between creativity and dyslexia may be genuine and tied to the neurological wiring of the brain. They argue that the dyslexic gene may be resistant to evolution because it provides extraordinary talents in other areas like creativity. This idea depends on how one defines or views dyslexia – as a disability in reading and writing or as a difference in brain structure. For example, Eide and Eide (2011) do not view the problem in the context of reading and writing; instead, they examine the benefits that come from being dyslexic. They indicate that dyslexia is not just a learning disability but a processing style, or "an entirely different pattern of brain organization and information processing" (p. 4).

Second, Wolff and Lundberg suggested that a separate construct may lead to co-morbidity, and dyslexia and creativity are not related. Similar to the first theory, the theory that dyslexia and creativity are products of a third construct can be supported with the idea that the dyslexic brain has a larger right hemisphere and that artistic creativity is a product of the right hemisphere (Everatt, 1997; Gordon, 1980). Although Gordon (1980) found that not only did people with dyslexia have a right hemisphere dominance, Everatt et al. (1999) tested to see if the bigger right hemisphere caused dyslexia and creativity, as well as visual-spatial ability by correlating them with other known right hemisphere abilities, e.g., field dependence and diffused attention, however, they found inconclusive results.

Third, dyslexic students' academic struggles may foster creativity by forcing them to develop coping strategies for success. This idea is supported by Everatt's et al. (1999) finding of

higher creativity in dyslexic adults as opposed to non-dyslexic adults, yet no differences in childhood. However, Kapoula et al. (2016) found that children and teenagers with dyslexia were more creative than their peers (and could be as creative as art students in college), which would argue against the claim that increased creativity in people with dyslexia is due to compensatory strategies.

Finally, the high proportion of students with dyslexia in the art field suggests an additional possibility. Wolff and Lundberg (2002) hypothesize that academic failures can prevent students from pursuing more traditionally academic fields, or may lead to students seeking out non-academic alternatives. The authors tested this claim by looking at 74 students from two competitive art universities and 80 students from economic and commercial law schools. They gave participants self-report measures of dyslexia, a word recognition test, and a famous author recognition test. Based on their criteria, they found a 15% prevalence rate of dyslexia in the art school students (11 students total) but only a 1.3% prevalence in the traditional academic fields (one student).

They replicated this study to include a larger sample, added diversity to the programs selected, and included a phonological skills assessment. Regardless of the level of strictness for their criteria, the prevalence of students with dyslexia was significantly higher in art programs than in other academic programs. Due to the competitiveness of the art programs, Wolff and Lundberg argued that the higher incidence of dyslexia in the fields is based on real talent and not as a way to escape more traditionally academic areas. Their finding is consistent with a case study where students were asked for their reasoning behind studying art (Bacon & Bennett, 2013). Bacon and Bennett (2013) gave 13 art students with dyslexia a semi-structured interview on their choice to study art. Eight of the 13 indicated that they actively sought to study art due to

a long-standing interested and or acknowledged talent. Although some perceived limited alternate academic options, all considered being an artist with dyslexia to be a positive personal identity.

Creativity, dyslexia, and visual-spatial ability. The first two possible explanations suggest additional genetic strengths (regardless of whether the dyslexia-creativity connection is genuine). Researchers have looked at dyslexia, creativity, and visual-spatial ability with the hypotheses that they are the product of a larger right hemisphere in the brain (Everatt et al., 1999; Gordon, 1980).

In a study, college students were assessed on various measures, including spelling ability, spatial ability, and creativity. There was no difference between students with dyslexia and controls in the two spatial ability tasks (Raven Matrices and Spatial Reasoning); however, students with dyslexia outperformed students without dyslexia in both verbal and figural divergent thinking tasks (Everatt, 1997).

A more recent study included visual-spatial ability as measured by mental rotation and block design (matching designs with the same orientation). Again, the researchers found that students with dyslexia performed better than the controls in creativity. However, there were no differences between groups in visual-spatial ability (Everatt et al., 1999). Lockiewicz, Bogdanowicz, and Bogdanowicz (2014) found no differences in visual-spatial ability, but also did not find differences in verbal or figural creativity.

Purpose of the Study

Although it is widely believed and hypothesized that visual-spatial ability is a strength for people with dyslexia, empirical research has generally found no difference between students with dyslexia and controls (Gilger et al., 2016). Attree et al. (2009) found a significant difference in a

computer-generated virtual environment test and suggested that the strength may lie in real-life measures. In the realm of creativity, the measures used are domain-general and do not look at actual creative products. Also, creativity has been measured separately from visual-spatial ability; no study has used a three-dimensional measure of creativity. Like Attree et al. (2009), Eide and Eide (2011) indicated that students with dyslexia are more creative in realistic areas.

The purpose of the study was to examine visual-spatial creativity for students with dyslexia by examining actual three-dimensional products created by these students. Students with and without dyslexia were asked to create a three-dimensional sculpture, which was evaluated by qualified raters using the Consensual Assessment Technique (CAT). This product was also compared to a two-dimensional drawing, a written description, and an oral narrative created by the same student to see how their strengths vary by domain.

RQ1: Do students with dyslexia show a similar pattern as students without dyslexia in creative ability?

RQ2: Do students with dyslexia, as compared to their non-dyslexic peers, evidence more or less creativity in the areas of building, drawing, writing, or storytelling?

RQ3: In what specific domains are students with dyslexia most creative?

RQ4: Do three-dimensional creative products differ from a psychometric visual-spatial measure for students with dyslexia compared to their non-dyslexic peers?

CHAPTER III: METHOD

Participants

This study was conducted with the approval of the University of Connecticut Storrs Institutional Review Board (IRB). Participants were treated in accordance with the American Psychological Association's (APA's) Ethical Guidelines.

Participants consisted of 49 middle school students in the Northeastern part of the United States. Twenty-four were male, and 25 were female; ages ranged from 9 years, 11 months to 14 years 11 months, and students ranged from 4th to 8th grade. Overall, 61.2 % were White, 10.2% were Asian, 8.2% were Hispanic, 2% were African American, 10.2% did not provide a response, and 8.2% were another race: Mayan, Turkish, or Bi-Racial. Additionally, 8% of the participants spoke Spanish at home, 8% spoke Korean, and 2% spoke Turkish. In terms of socio-economic status, 12.2% of the students received free or reduced lunch, 85.7% received regular lunch, and 2% did not provide information about lunch status.

Students were placed in the clinical group if they had a diagnosis of dyslexia, or an educational diagnosis of Specific Learning Disability (SLD) in reading and or had an Individualize Education Program (IEP) that consisted of reading supports. Students in the control group could not have an SLD in reading or have received interventions to remediate reading. Of the 49 students, 15 had an IEP, ten of which had an SLD in reading, eight in writing, and three in math. Four had Attention Deficit Hyperactivity Disorder (ADHD), two had an IEP for speech and language, and one had autism. A separate question was asked regarding a diagnosis of dyslexia; 17 students had said diagnosis. Additionally, of the 49 students, three were excluded because they had received interventions for reading but were not identified as a student with a disability, two were excluded due to missing data, and one was excluded due to being in the 4th

grade. Of the remaining 43 participants, 18 qualified for the clinical group. The remaining 25 participants were placed in the control group. Table 1 provides the demographic information for the full sample along with the information for each group.

Recruitment for the study began in the Fall of 2017 and ended in the Winter of 2019. Students were recruited from various places by various forms. Ten percent were recruited from public schools, 29% from private schools, 41% were part of a research study listserv, and the remaining 20% were recruited through social media. In the cases of school and social media recruitment, a flier was posted in the school's newsletters or on Facebook, and parents volunteered to have their child participate (See Appendix A). In the case of the research listserv, parents received a direct call or email from the researcher informing them of the study. Parents who were interested reached out to the researcher. The majority of the control group was recruited through the listserv (66.7%), followed by social media (22.2%), and the remaining students in the control group were recruited through public schools (11.1%). For the clinical sample, the majority of students were recruited from private schools (77.8%), and the remaining students were recruited through social media (22.2%; See Table 2). To have power at the $\beta = .85$ level for a repeated measures, a mixed-methods design with two groups and four measurements and ten comparisons, G*Power 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007) required 42 participants. Forty-three qualified for the study. However, there is an unequal distribution between the clinical and control group.

Measures and Materials

Creative measures. Four creative products were measured using the Consensual Assessment Technique (CAT; Amabile, 1996). As mentioned in Chapter 2, the CAT measure requires participants to produce real-world products that are rated for creativity by expert or

quasi-expert raters. During the rating process, products are compared to one another, and not to a predetermined ideal. The raters do not communicate with each other during this process; however, studies have consistently shown high inter-rater reliability as high as .80 to .99 (Baer et al., 2004; Dollinger & Shafran, 2005; J. C. Kaufman et al., 2013; J. C. Kaufman, Lee, Baer, & Lee, 2007).

To create the products, students were asked to think of four imaginary creatures in their heads. They had ten minutes to describe one orally (oral narrative), ten minutes to describe one in writing (written description), ten minutes to draw one on paper (two-dimensional drawing), and ten minutes to build one with clay (three-dimensional sculpture). Each creature had a made-up name so that students could keep them separate across conditions. The prompts were provided in writing but also read to them for each condition: “I want you to think of four different imaginary creatures. Creatures that you have never seen or heard of before. Create your creatures in your head. These creatures will be named Koh, Zuke, Lops, and Neef. I will ask you to describe one verbally, describe one in writing, draw one, and build one. But you won’t know which.” See Appendix B for student sheets.

Oral narrative: Students were told, "Using this tape recorder, I want you to describe how _____ would look like. Use as much detail as possible. Be as creative as you want, you are able to have fun with this." Students were given a half sheet of paper with the prompt as well. They were then recorded with a Sony Digital Voice Recorder. The recording was saved with the student's designated identification number. All audio recordings were put in a zip file and sent to the raters.

***Written description*:** Students were told, “I want you to describe in writing how _____ would look. Use as much detail as possible. Don’t worry about spelling, but feel free to ask how

to spell something. If you like, we can go over any spelling questions after. Be as creative as you want, you are able to have fun with this." Participants were given a sheet of paper with lines and the prompt listed above. Written products were transcribed and edited for spelling only, before being sent to the raters in an excel sheet.

***Two-dimensional drawing*:** Students were told, “Using the paper and color pencils provided, I want you to draw what _____ would look like. Use as much detail as possible. Don’t worry about drawing ability, just try your best. Be as creative as you want, you are able to have fun with this.” Students were given a sheet of paper with a box where the drawing was meant to be. Similarly to the written product, the directions were written at the top of the page. Students were given six color Crayola color pencils: black, brown, red, blue, yellow, and green. Drawings were scanned and sent to the raters within a PDF document.

***Three-dimensional sculpture*:** Students were told, "Using the material provided, I want you to build what _____ would look like. Use as much detail as possible. Don't worry about building ability, just try your best. Be as creative as you want, you are able to have fun with this." Students were provided with a one-quart plastic jar and asked to build their sculpture on the lid. Students were informed that the sculpture had to fit within the jar and that it needed to close. The lid was marked with the student's ID in the front, and notched on the three other sides. To create the sculpture, students were provided with: Crayola molding clay, two ounces of red, yellow, blue, and green (eight ounces total); four toothpicks; and two pipe cleaners (black and white). Students were informed that they could use as much or as little of the materials provided in any way they wanted to, to create their sculpture. Four pictures were taken of each product from three different angles: a front view, a top view, and an angled view for a total of 12

pictures. The pictures for each student were placed in a file with their ID number. All files were sent to the raters in a zip file.

Counterbalancing. The order of the conditions was counterbalanced so that there would not be any practice effect on the creative tasks. The name of each creature for each domain was also counterbalanced to prevent a name that possibly encourages more creativity to be linked to a specific domain. The counterbalanced design was created by coming up with each combination of four variables, first by domain and then by name. The order was then randomized and merged.

The four tasks were scored for creativity by five raters based on their personal definition of creativity; no additional guidance, descriptors, or material on creativity were provided. This format is consistent with Amabile's (1996) CAT method. The raters assigned scores on a Likert scale from 1 (*not at all creative*) to 6 (*extremely creative*). A creative score was derived by averaging the scores from all the raters for that domain creating an index score. As such, the data is being used as interval data. As Sullivan and Artino (2013) indicated, parametric tests can be used to analyze Likert scale responses. Each student has an Oral Creative Score, a Written Creative Score, a Drawn Creative Score, and a Built Creative Score. Based on J. C. Kaufman and Baer (2012), quasi-experts were used as raters. These were people with a certain degree of expertise in the area of creativity. They were recruited from the areas of, Psychology, Education, and Creativity. For the current study, coefficient alpha was calculated for each domain: written description, $\alpha = .90$, for the oral narrative $\alpha = .88$, for the two-dimensional drawing $\alpha = .84$, and for the three-dimensional sculpture, $\alpha = .84$.

Visual-spatial measure. Visual-spatial ability was measured using the Visual Puzzles subtest of the Wechsler Intelligence Scale for Children, Fifth Edition (WISC-V). This subtest

requires the participant to work within a specified time limit, to views a completed puzzle and selects three response options that, when combined, reconstruct the puzzle (Wechsler, 2014). This subtest contains 29 questions with a 30-second time limit for each. Raw scores range from 0 to 29 and are converted to scaled scores (M = 10, SD = 3). The mean reliability coefficient for this measure is .81 (Wechsler, 2014).

Demographic information. Demographic information was gathered for scheduling, group-make up, and grouping purposes. Questions included basic contact information for parents, Student demographic information: name, school, grade, date of birth, gender, ethnicity, primary language, and secondary language if applicable. Additionally, a question on lunch status was asked to determine social-economic status. The remaining questions were used for grouping purposes: does your child: have a diagnosis of dyslexia, has received reading interventions, has an IEP, if so, under what category. School secretaries collected this information for students recruited from the public school setting and provided it to the researcher in an excel file. An online survey through the university's Qualtrics subscription was also used to collect basic demographic information. Parents who had contact with the researcher through email were sent a link for the survey. Other parents were provided with an iPad at the time of data collection to fill out the survey.

Self-efficacy Measures[1]. In addition to a more extensive study, students also completed a survey on self-efficacy. For the purpose of the study, these data were not analyzed or reported in the results or discussion. See Appendix C for the survey.

[1] Self-efficacy was assessed using the Creative self-efficacy (CSE) measure and academic self-efficacy (ASE) measure, which are modified form Beghetto (2006) and Beghetto et al. (2011). Beghetto et al. (2011) used their measure to assess creativity in math and science, which had a reliability of alpha = .90. The measures were modified to look at creativity in general (five questions) and to look at academic achievement (6 questions). Students rated themselves on a

Additional measures were proposed for matching and group selection; however, they were removed due to difficulty in recruitment. See Appendix D.

Procedures

Recruitment flyers were posted on schools' newsletters and social media or emailed to parents on the listserv. In the school settings, students turned in signed consent forms to the school secretary, who then provided the researcher with times when the student could be pulled for the study. In all other settings, parents had direct communication with the researcher or research assistant and scheduled a time to meet. Students, along with parents, were required to sign the consent form and a release to be audio recorded for the oral narratives (Appendix E). Although students had to sign the consent form to participate, they were still asked for their assent before beginning the study (Appendix F). Students began with the two pre-self-efficacy measures. They then produced the four creative products which were administered in a counterbalanced order and were given up to ten minutes for each domain. The post-self-efficacy measure was administered, followed by the Visual Puzzles subtest. The session took approximately 50 minutes to complete. When done, students were able to create their gift bag by choosing a pencil pouch, a pencil, pencil topper, puzzle eraser, and two-inch thinking putty tin. Students were thanked and excused. Once all the data were gathered, password protected files were sent through a secure server for the raters to rate.

Research Design

The first design for the first three research questions consisted of a 2x4 quasi-experimental mixed methods design to analyze creativity by two groups and four domains.

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scale indicating that the statements are not true of themselves (1) to very true of themselves (5). The items for each domain are averaged and range from 1.0 to 5.0.

Group was a between-subject measure: students with dyslexia (clinical) versus students without dyslexia (control); domain was a within-subject measure looking at oral narratives (oral), written descriptions (written), two-dimensional drawings (drawn), and three-dimensional sculptures (built). See Figure 2.

The second design for the fourth research question consisted of a 2x2 quasi-experimental mixed-method design to analyze visual-spatial ability between two groups and two methods. Similar to the first analysis, group was a between-subject measure, students with dyslexia (clinical) versus students without dyslexia (control); method was a within-subject measure comparing a standardized visual-spatial assessment (Visual Puzzles) with a three-dimensional sculpture (built). Scores for both measures were converted to z-scores for a more accurate comparison. See Figure 3.

Data Analysis

Two two-way mixed ANOVAs were conducted for this study. Before running any analysis, the dependent variables (four creative products and the visual-spatial measure) were analyzed for significant outliers using studentized residuals values greater than +/- 3. The normality of the data within each cell was assessed using the Shapiro-Wilk's test. Additionally, due to the type of analysis, three additional assumptions were required. Homogeneity of variance was assessed with the Levene's test for equality of variance, homogeneity of covariance with the Box's test of equality of covariance matrices, and Sphericity with Mauchly's test of sphericity. All tests required a significance level of $p > .05$.

For the first three research questions, a two-way mixed ANOVA was conducted between two groups and across four domains. The first research question: "Do students with dyslexia show a similar pattern as students without dyslexia in creative ability?" was analyzed based on

the interaction term. A significant interaction term indicates that there is a difference between groups depending on the domain. Simple effects were used as *post hoc* comparisons for the second and third research questions. For RQ2: “Do students with dyslexia, as compared to their non-dyslexic peers, evidence more or less creativity in the areas of building, drawing, writing, or storytelling?” simple effects compared the groups within each domain (four comparisons). For RQ3: “In what specific domains are students with dyslexia most creative?” simple effects compared the different domains within the dyslexia group (six comparisons). A total of ten comparisons require an α of .005 based on the Bonferroni correction.

The last research question: "Do three-dimensional creative products differ from a psychometric visual-spatial measure for students with dyslexia compared to their non-dyslexic peers?" requires a two-way mixed ANOVA between two groups and across two measures. Due to the measures being on different scales, they were converted to z-scores for better interpretation. Additionally, the assumption of sphericity is not required, as there are only two dependent variables. *Post hoc* tests were not required as each dependent variable only has two levels. As such, the main effects of group and measure indicated if there is a significant difference between the two groups.

CHAPTER IV: RESULTS

Descriptive Statistics

Descriptive statistics were conducted on all of the dependent variables in the study, including their z-score conversion counterparts. There were no outliers, as assessed by examination of studentized residuals for values greater than +/- 3. Creativity and visual-spatial ability were normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$); See Table 3.

Analysis of Creativity

For the first three research questions, a 2x4 mixed ANOVA was conducted. There was homogeneity of variances ($p > .05$) and covariances ($p > .001$), as assessed by Levene's test of homogeneity of variances and Box's M test, respectively. Mauchly's test of sphericity indicated that the assumption of sphericity was not met for the two-way interaction, $\chi 2(5) = 19.189$, $p = .002$. As such, Greenhouse-Geisser was used to interpret the F test.

For the first research question, Do students with dyslexia show a similar pattern as students without dyslexia in creative ability? There was a statistically significant interaction between domain and group on creativity $F(2.317, 95.005) = 3.203$, $p = .038$, partial $\eta 2 = .072$ (see Table 4), indicating that creative ability differed by domain for each group. As can be seen in Figure 4, students with dyslexia and controls differed in some domains and not others.

In terms of the second research question: Do students with dyslexia, as compared to their non-dyslexic peers, evidence more or less creativity in the areas of building, drawing, writing, or storytelling? Simple effects analysis revealed that Creativity in writing was significantly higher in the control group than the dyslexia group ($M = 1.20$, $SE = .29$, $p < .001$). No other domain was significantly different (see Table 5).

For the final research question related to creativity, In what specific domains are students with dyslexia most creative? Simple effects analysis did not reveal any significant differences between any of the domains for students with dyslexia at the $p < .005$ level (see Table 6). However, when looking at Cohen's *d*, there is a large effect between written and built products ($d = .821$). Additionally, we see moderate effects between the built and drawn products ($d = .553$) and the built and oral products ($d = .549$).

Analysis of Visual-Spatial Ability

The final research questions revolved around visual-spatial ability, Do three-dimensional creative products, differ from a psychometric visual-spatial measure for students with dyslexia compared to their non-dyslexic peers? A 2x2 mixed ANOVA was conducted to assess the difference between groups and visual-spatial measures. There was homogeneity of variances ($p > .05$) and covariances ($p > .001$), as assessed by Levene's test of homogeneity of variances and Box's M test, respectively. Mauchly's test of sphericity was not required, as each group only had two levels. There was no statistically significant interaction between group and measure of visual-spatial ability, $F(1, 41) = 0.717$, $p = .402$, partial $\eta 2 = .017$. Additionally, there was not a significant main effect for visual-spatial measure $F(1, 41) = 0.216$, $p = .644$, partial $\eta 2 = .005$ or group $F(1, 41) = 0.416$, $p = .522$, partial $\eta 2 = .010$, see Table 7. As can be seen in Figure 5, the lines between measures by group are essentially parallel.

CHAPTER V: DISCUSSION

Typically, when a student has a learning disability in reading/dyslexia, interventions focus on remediating the weakness. Positive psychology is a field of psychology that looks at helping people, based on harnessing a person's strengths to create better outcomes (Edwards, 2016). Strengths-based/asset-based interventions have been used with people with developmental disabilities to learn new skills (e.g., Dunst et al., 2017; Raab et al., 2016). This study hoped to help identify strengths for people with dyslexia in two areas that have been hypothesized to be areas of strengths for them: creativity and visual-spatial ability. Creativity has typically been assessed with domain-general measures rather than actual measures of creativity. Similarly, the visual-spatial ability has been measured with paper-and-pencil tests. Eide and Eide (2011) have suggested that students with dyslexia may be better able to demonstrate their strengths using real-world measures. The purpose of this study was to compare students with and without dyslexia with real-world products. More specifically, to see if they had different patterns of creative abilities, to assess in what areas they differed between groups, and within the dyslexia group, and to determine where their strengths lay. An additional question inquired about the difference between a psychometrically validated visual-spatial measure and a real-world three-dimensional creative product.

Summary of Results

In terms of the first research question, students with dyslexia did not show a similar pattern in creative ability relative to students without dyslexia. For students with dyslexia, three-dimensional sculptures were their strongest area, followed by two-dimensional drawings, oral narratives, and lastly, written descriptions. However, for the controls, Written descriptions were their strongest area, followed by two-dimensional drawings, three-dimensional sculptures, and

lastly, oral narratives. For the second research question, a difference in creative writing (written descriptions) was identified between the two groups. Students without dyslexia outperformed students with dyslexia in this domain. While written descriptions were the control group's strongest area, it was the dyslexia group's weakest. This is a logical finding given that students with dyslexia struggle with spelling and in turn, written products. This will be discussed more fully in the limitation section. Additionally, this finding validates the classification of the clinical sample as a dyslexia or specific learning disability group. No other significant differences were identified in the other domains. The third research question focused on students solely in the dyslexia group. Though there was no statistical significance after controlling for Type 1 error, there was a strong effect between the written descriptions and three-dimensional sculptures. There was also a moderate effect when comparing the three-dimensional sculptures to the two-dimensional drawings and oral narratives. As for the final question, there was no difference between group or measure on visual-spatial ability.

Conclusion

In the current study, although only one domain had a significant difference between groups, students with dyslexia performed lower than their peers on all creative products. This is inconsistent with studies that found that people with dyslexia performed higher in both verbal and drawing tasks (Everatt, 1997). Everatt's (1997) study used divergent thinking tasks in adults. Everatt et al. (1999) replicated Everatt's (1997) study and found similar results. However, when the study was conducted with children, there was no significant difference between the groups, suggesting that creativity may develop with age. The current results were consistent with Lockiewicz et al. (2014), who found no difference between groups on nonverbal tasks. Tafti et al. (2009) found that although students with dyslexia did not differ from peers on other measures

of creativity, they were superior in originality. N. L. Kaufman and Kaufman (1980) found a similar result with students with minimal brain dysfunction. This appears to be a pattern in the literature. Cancer et al. (2016) found that students with dyslexia scored higher on a connecting task (i.e., identifying relationships or unusual combinations of ideas). Everatt et al. (1999) found that adults with dyslexia were more innovative by looking past the typical and had higher creative insight than adults without dyslexia.

In terms of visual-spatial ability, as Gilger et al. (2016) found in their literature review on spatial reasoning and reading, students with dyslexia did not significantly differ from their non-dyslexic peers. Out of 57 assessments comparing students on different measures of visual-spatial ability, students with dyslexia were higher in six of them. They were significantly lower in ten of them and were the same in 41 cases. More specifically, Everatt (1997), Everatt et al. (1999), and Attree et al. (2009) found no difference in spatial abilities on cognitive measures of visual-spatial ability. Brunswick et al. (2010) and Lockiewicz et al. (2014) also did not find a difference on cognitive measures when comparing between groups; however, they did find a gender effect where males were higher on visual-spatial measures, a gender difference that has long been found repeatedly in the literature, at all ages, on all types of visual-spatial tasks (e.g., Hyde, 1981).

Von Károlyi (2001) and Von Károlyi et al. (2003) found a significant difference in reaction time when identifying impossible figures, a visual-spatial global task (though accuracy remained the same between groups). Similarly, Schneps, Brockmole, Sonnert, Pomplun, and Suzuki (2012) found that while students with dyslexia did not differ in contextual cueing on letter-like objects or natural scenes, they did perform better on low-pass filtered natural scenes (e.g., when pictures were blurred, thus removing possible distracting stimuli). These last three

studies focus more on the holistic visualization strengths for students with dyslexia of complex figures. This may be consistent with creativity research mentioned above, indicating that students with dyslexia may have a strength in originality (N. L. Kaufman & Kaufman, 1980; Tafti et al., 2009), finding connections between unusual pattern of ideas (Cancer et al., 2016), and being more innovative (Everatt et al., 1999).

Thus, although visual-spatial ability as a whole may not be a superior strength for students with dyslexia compared to controls, it is still important to note that this is an area where students with dyslexia may not be at a disadvantage compared to their peers. The combination of these skills--reaction time, wholistic visualization, and original thinking--may all be contributing to what others anecdotally see when speaking of these students' strengths. Also, another avenue is that the studies that looked at gender as a component found that males tend to be better at visual-spatial areas, a persistent research finding for Typical and exceptional individuals. Thus when gender is collapsed, the effect may be lost within the analysis.

In terms of students with dyslexia having stronger visual-spatial skills on real-world measures, these results were inconsistent with Attree's et al. (2009) study, where students with dyslexia performed better on a virtual reality measure. However, although there was no difference between groups or measures, it was the strongest area for students with dyslexia. This is an important finding because although they may not be superior in visual-spatial ability than controls, it is a personal strength that can be utilized.

Implications for Practice

Some people may interpret talking about strengths associated with dyslexia as the "dyslexia as a gift" argument. For many parents and students with dyslexia, the notion that dyslexia is a gift is an insult, as it minimizes the struggles that the students are going through

(Dekker Delves into Dyslexia, 2019; Johnson, 2015; Moats, 2016; Spoor-Hof, 2014). Some believe that it is fluff to make people feel good or possibly to sell something (Dekker Delves into Dyslexia, 2019). However, many of the same people, and others agree that it is important to identify students' strengths to help them overcome their weaknesses (Foss, 2014; McIver, ND; Miller, 2016). Miller (2016), a special education advocate, provides an example of how an IEP can be written utilizing a student's strengths rather than just focusing on the weakness. For example, if a student has significant difficulty in writing, the team can build supports around the writing interventions based on the student's strengths. If the student has a strength in oral storytelling and is good with technology, s/he can be taught how to use speech to text technology, and audiobooks to help increase vocabulary.

Why is it important to identify strengths and share them with students? Griffin and Pollak (2009) interviewed past and current college students and found that they tended to have one of two views about their disability: a "difference" view incorporating strengths and weaknesses, or a medical/deficit view where students were at a disadvantage. Those with a different view had higher career ambitions and academic self-esteem. This is important as self-esteem and self-efficacy are related to higher academic achievement (Bong et al., 2012; Lane, Lane, & Kyprianou, 2004). Additionally, areas of strengths, can and need to be nurtured.

Kapoula et al. (2016) found that the educational approach had an impact on creativity in students with dyslexia. When comparing three schools that specialized in working with students with dyslexia, they found that the school that emphasized individual students' needs, and taught them how to take into account their individual differences by creating their own objectives and mobilizing resources to overcome difficulties, scored higher in creativity (and as high as college art students in certain measures). The schools that only focused on students' disability and

worked on normalizing reading and academic performance, scored lower on creative measures. This is consistent with Magyar-Moe's et al. (2015) reasons why students' strengths needed to be nurtured. It would be interesting to see how these teaching ideals also affect students' academic achievement.

Limitations

There were some limitations to consider when interpreting the results. Due to difficulty with recruitment, measures that were initially put in place to control for differences between groups, e.g., oral language ability and intellectual ability, had to be removed along with measures to assess for reading ability (see Appendix D). As such, the two groups may have been different along other lines, e.g., oral language ability rather than just creativity. This is important because Alves and Nakano (2014) found that creativity measured with The Child Figural Creativity Test was correlated with intelligence as measured by the Raven's Colored Progressive matrices (r = .728). Additionally, Mourgues et al. (2014) found that students with better verbal abilities were more creative, with seven to nineteen percent of the variance in creativity being accounted for by reading measures. Given that students with dyslexia have a higher prevalence of language impairments (Catts et al., 2005) and their language abilities possibly being lower due to reduced exposure to text (Lyon et al., 2003), they may have been at a greater disadvantage when not controlling for these constructs.

Also, group membership was decided based on parent report, i.e., if the student had an IEP for reading or a previous diagnosis of dyslexia. As such, the researchers were unable to confirm or disconfirm the diagnosis based on psychometric testing. Despite removing these screening measures to reduce the amount of time the student was participating in the study, recruitment was still difficult, resulting in a small sample size, which may have affected the

power that was needed to find significant results specifically within the dyslexia group. Power analysis for a two-way repeated-measures ANOVA with a .25 effect size, .005 alpha, and .85 beta required 41 participants. However, there were only 18 students with dyslexia in the current study.

An interesting observation while collecting data was that students with dyslexia who were recruited by their parents were more hesitant about participating in the study than students that volunteered to participate themselves. Despite reassuring them that they did not have to participate in the study, they indicated that they wanted to continue. However, it appeared that these students rushed through activities to be done as soon as possible. This did not appear to be a problem for students in the control group.

In terms of generalization, as Shogren (2013) indicated, "Although the field of intellectual and developmental disabilities has been dominated by a focus on deficits and limitations, each person with a cognitive and developmental disability – just as any person with or without a disability – has a unique profile of strengths, interests, abilities, and support needs" (P. 1). As such, though the study is attempting to identify strengths within a group of people, it is important to identify strengths in each individual person, so we may better support their specific needs.

Recommendations for Future Research

Future research can extend this study with an increased sample size and the appropriate controls mentioned above. To address some of the conflicting findings with past research, a domain-general measure of creativity may be beneficial. Also, evaluating the creative products for fluency, flexibility, originality, and elaboration may be helpful. Besides controlling for cognitive and language measures, gender may also need to be included in the analysis. Due to the

length of time required to complete all measures of the study, participants may benefit from a brief report containing their assessment results with recommendations.

If results are promising, future research can focus on creating interventions that utilize students' areas of strength. Depending on effectiveness, interventions may be able to focus on actual reading remediation, or focus more on a holistic view and help students with feelings of ineffectiveness and self-esteem. Though students tend to learn compensative strategies on their own, strength-based interventions may also be used to help teach students how to use their strengths to work around their weaknesses and help them succeed.

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TABLES

Table 1

Demographics Information

	Full Sample*	Controls	Clinical
n	49	25	18
Age			
Mean	12 years 6 months	12 years 6 months	12 years 7 months
SD	1 year 1 month	1 year 1 months	1 year
Range	9 years 11 months-14 years11 months	10 year 4 months-14 years 11 months	10 years11 months-14 years 5 months
Grade			
M (*SD*)	6.6 (3.3)	6.88 (1.01)	6.78 (0.81)
Range	4-8	5-8	6-8
Gender			
Male	24	11	8
Female	25	14	10
Ethnicity			
African American	2	0	5.6
Asian	10.2	16	0
Hispanic	8.2	4	5.6
White	61.2	68	55.6
Other	8.2	8	11.1
No response	10.2	4	22.2
Socioeconomic Status			
Regular Lunch	85.7	92	77.8
Free and Reduced	12.2	8	16.7
No response	2	0	5.6

Note: Ethnicity and SES data are reported as percentages.

*The full sample includes students that were excluded from the study due to missing data or exclusionary factors.

Table 2

Where Students were Recruited From.

	Full	Control	Clinical
Public school	10.2	11.1	0
Private school	28.6	0	77.8
Listserv	40.8	66.7	0
Social Media	20.4	22.2	22.2

Note: Numbers represent percentages

Table 3

Descriptive Statistics of Dependent Variables

	Control (n = 25)		Clinical (n = 18)	
	M (*SD*)	Normality	*M* (*SD*)	Normality
Creativity Measures				
Writing	4.04 (0.96)	.139	2.84 (0.89)	.624
Oral	3.54 (1.32)	.855	3.04 (1.07)	.175
Drawing	3.67 (1.02)	.174	3.09 (0.90)	.731
Building	3.61 (1.04)	.580	3.60 (0.95)	.872
Visual-Spatial Measures				
Visual Puzzles	11.96 (2.79)	.403	11.00 (3.53)	.883
Visual Puzzles z-score	0.121 (0.918)	.139	-0.195 (1.161)	.624
Building z-score	0.052 (1.012)	.580	0.044 (0.926)	.872

Note: Creative products can range from 1 to 6; Visual Puzzles ranges from 1 to 19. Building and visual puzzles were converted to z-scores so they fell within the same scale. Normality was assessed using Shapiro-Wilk's test; significant levels p>.05 are considered normal.

Table 4

ANOVA Results for Creative Ability

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	η^2	β
			Tests of Within-Subject Effects				
Domain	2.148	2.317	0.927	0.923	.413	.022	.219
Domain x Group	7.454	2.317	3.217	3.203	.038	.072	.643
Error	95.425	95.005	1.004				
			Tests of Between-Subject Effects				
Group	13.675	1	13.675	6.888	.012	.144	.727
Error	81.392	41	1.985				

Note. Within-subject results adjusted for sphericity with Greenhouse-Geisser correction.

Table 5

Post Hoc for Between Measures Ran as One-Way ANOVAs

Predictor	Mean Difference	Standard Error	*F*	*p**	η^2	β
Written	1.2	0.29	17.167	.000	.295	.981
Oral	0.5	0.38	1.745	.194	.041	.252
Drawn	0.58	0.3	3.767	.059	.084	.474
Built	0.01	0.31	0.001	.979	.000	.050

Note. Significance level is at $p < .005$ based on Bonferroni's correction for a total of 10 comparisons among the between- and within-subject measures.

Table 6

Post Hoc for Within Measures Ran as Simple Effects

Comparison	Mean Difference	Standard Error	*p**	*d*
Written - Oral	-0.20	0.21	.348	.203
Written - Drawn	-0.24	0.25	.331	.273
Written - Built	-0.76	0.31	.019	.821
Oral - Built	-0.56	0.37	.137	.549
Drawn - Built	-0.51	0.29	.081	.553
Oral - Drawn	-0.04	0.32	.889	.045

Note. Significance level is at $p < .005$ based on Bonferroni's correction for a total of 10 comparisons among the between- and within-subject measures

Table 7

ANOVA Results for Visual-Spatial Ability

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	η^2	β
			Tests of Within-Subject Effects				
Visual-Spatial (VS)	0.15	1	0.150	0.216	.644	.005	0.074
VS x Group	0.496	1	0.496	0.717	.402	.017	0.131
Error	28.357	41	0.692				
			Tests of Between-Subject Effects				
Group	0.548	1	0.548	0.416	.522	.010	0.097
Error	53.944	41	1.316				

FIGURES

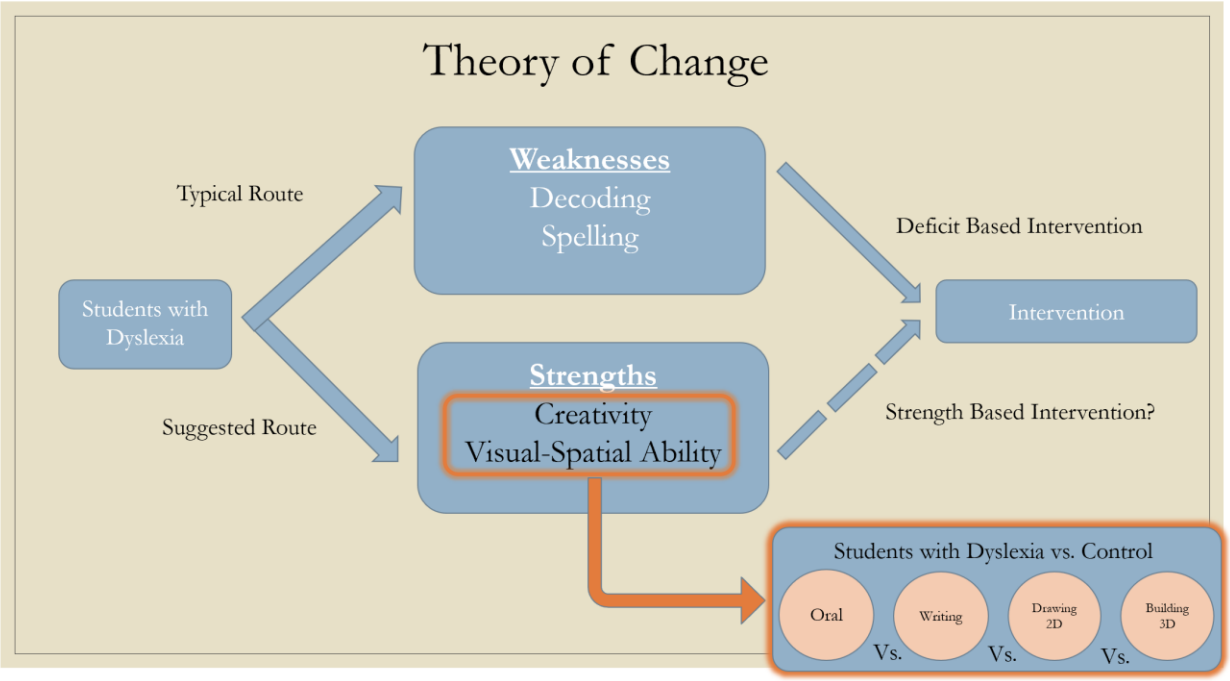

Figure 1. When the word dyslexia is heard, people tend to typically think about the reading difficulties associated with it and the interventions to remediate it. Researchers have begun to look into strengths that are believed to be associated with dyslexia. This study attempted to identify such strengths, with the hopes that they may be used to inform interventions.

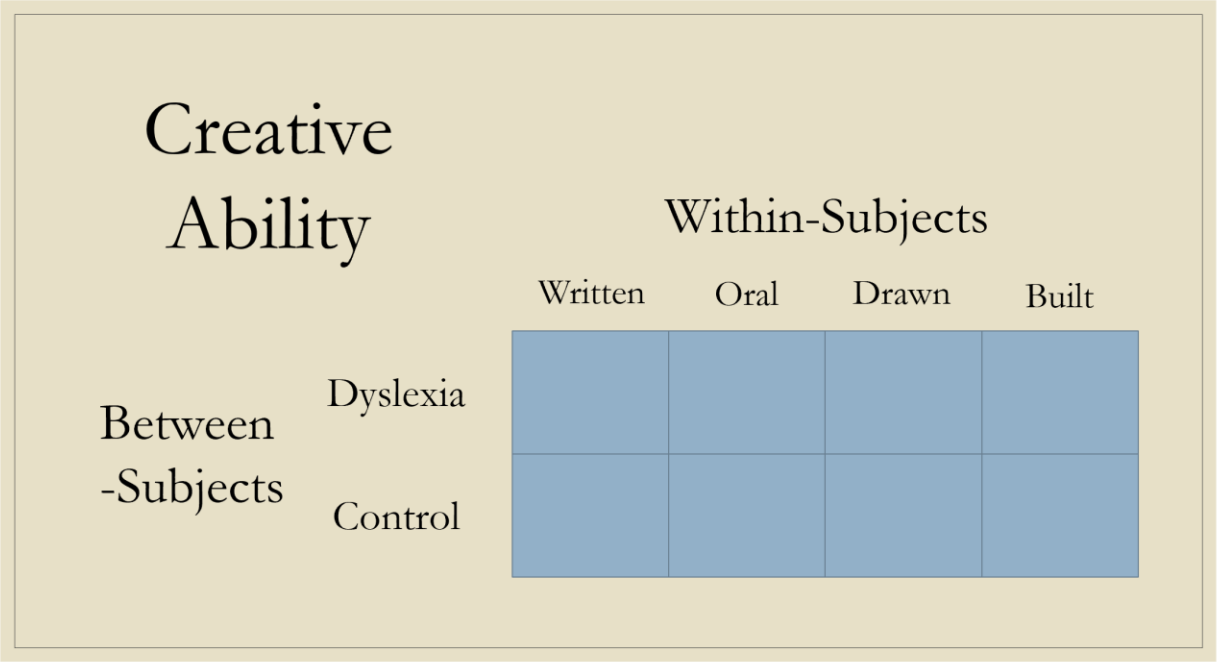

*Figure 2:*Design for research questions one, two, and three: 2x4 mixed methods design looking at two groups (dyslexia and control) as a between-subject measure and four domains (written, oral, drawn, and built) as a within-subject measure.

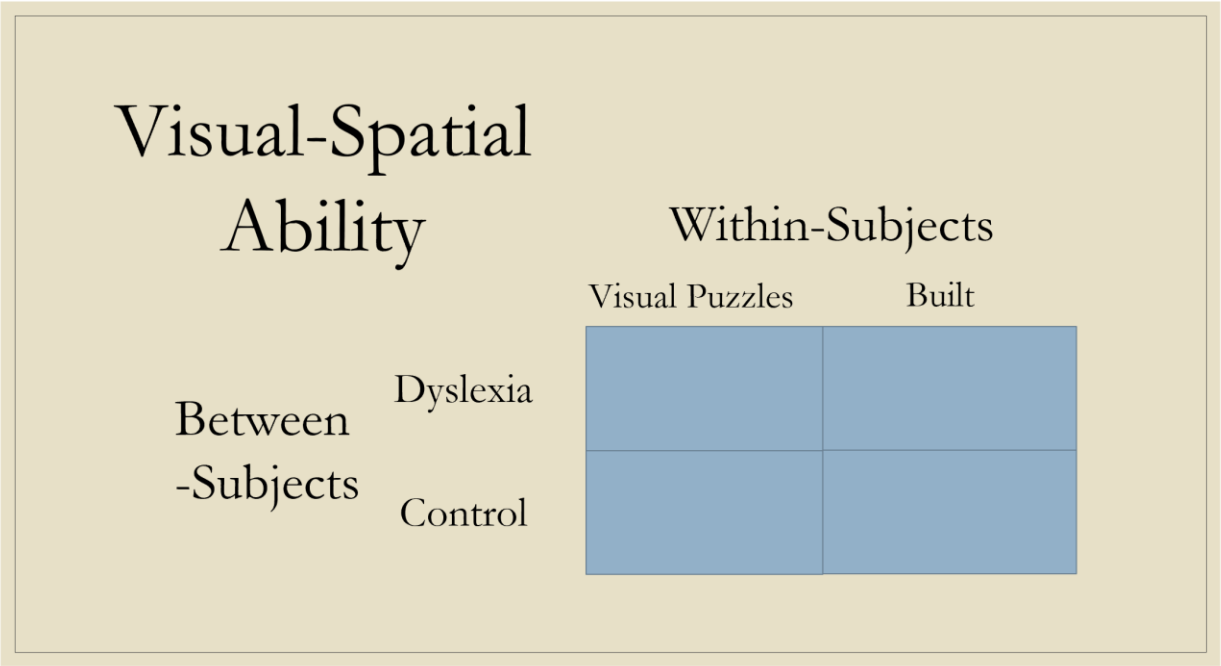

*Figure 3:*Design for research questions four: 2x2 mixed methods design looking at two groups (dyslexia and control) as a between-subject measure and two methods (Visual Puzzles, and built) as a within-subject measure.

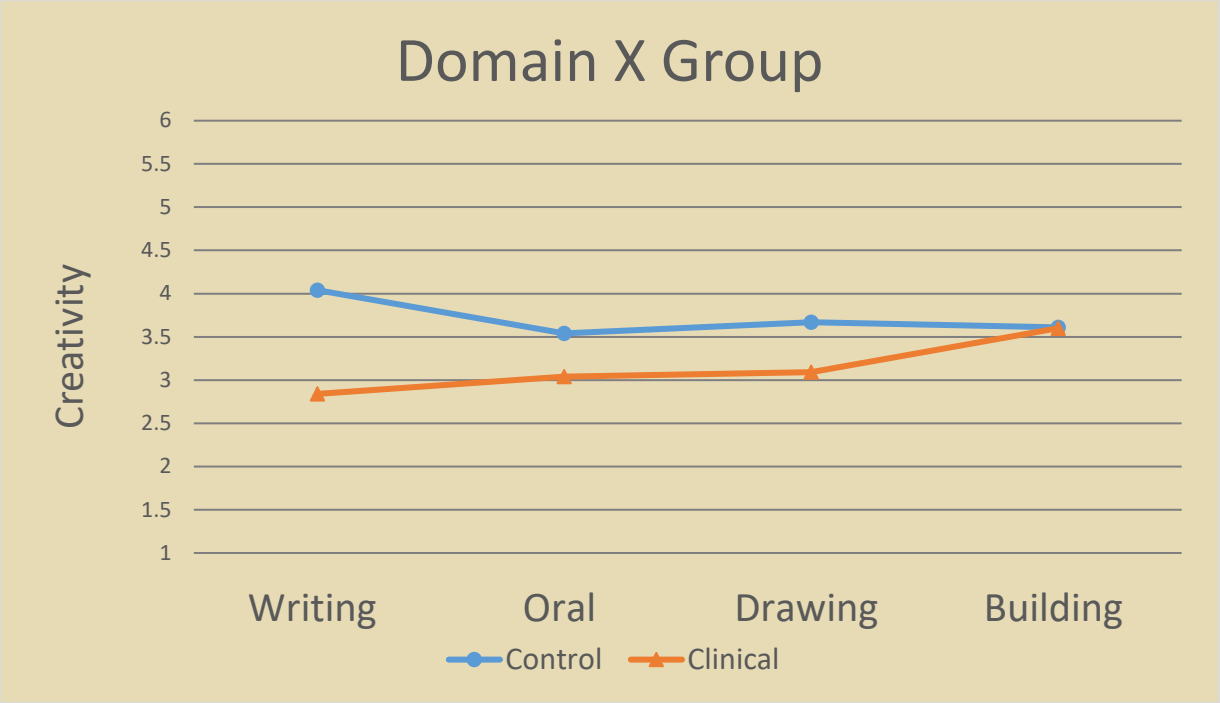

*Figure 4:*Group creativity means by domain split between two groups.

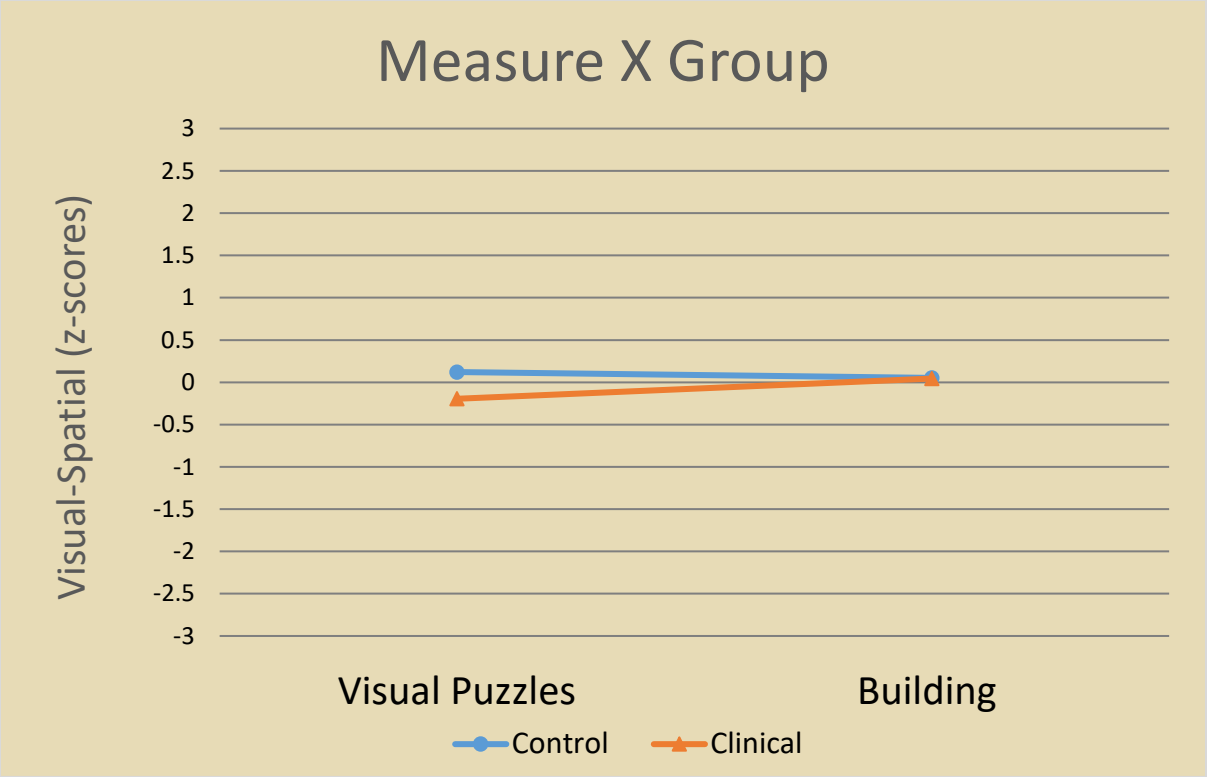

Figure 5: Group visual-spatial means by measure split between two groups

APPENDICES

Appendix A: Recruitment Flyer

UCONN
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Students Needed for a Research Study

Differences in creativity across domains between students with dyslexia and those without

The purpose of this research study is to identify strengths in the area of creativity for students with and without dyslexia. The hope is that by identifying strengths for students with dyslexia, we can better understand what these students can do rather than what they cannot and later investigate how these strengths can be used for future interventions.

We are looking for middle school students in grades 6-8 to participate in this study. Students will be split between those that have and don't have a specific learning disability in reading (Dyslexia).

Students will produce four creative products that will be compared between and within groups. Products will be drawn, written, built, and described orally. They will also do a visual spatial measure. This will take about an hour to complete

Your child will not experience any direct benefit from this study, but their participation will help increase the scientific knowledge base which may benefit other students in the future. However, for their participation, they will receive a thank you gift valued around $5 in the form of school supplies, thinking putty, and/or stickers.

To be included in this research, your child must be in middle school and pass a quick screener to be matched with a student from the opposite group. For more information, contact the student research at maria.avitia@uconn.edu with any questions.

This study is being conducted as a dissertation study by Maria J. Avitia under the supervision of Dr. Melissa Bray, professor of School Psychology at the University of Connecticut Storrs.

UCONN IRB PROTOCOL H17-096 APPROVED 6/5/18

Oral

Using this tape recorder, I want you to describe how _____ would look like. Use as much detail as possible. Be as creative as you want; you are able to have fun with this.

Building

Using the material provided, I want you to build what _____ would look like. Use as much detail as possible. Don't worry about building ability, just try your best. Be as creative as you want; you are able to have fun with this.

Writing

I want you to describe in writing how _____ would look. Use as much detail as possible. Don't worry about spelling, but feel free to ask how to spell something. If you like, we can go over any spelling questions after. Be as creative as you want; you are able to have fun with this.

Drawing

Using the paper and color pencils provided, I want you to draw what _____ would look like. Use as much detail as possible. Don't worry about drawing ability, just try your best. Be as creative as you want; you are able to have fun with this.

Appendix C: Self-Efficacy Measures

Please rate your responses below on a 1 to 5 scale.

1	**2**	**3**	**4**	**5**
Not at all true of me,		Somewhat true of me		Very true of me

Creative Self-Efficacy

1) _____ I like coming up with new ideas.
2) _____ I have a good imagination.
3) _____ I have a lot of new ideas.
4) _____ I am good at coming up with my own creative projects.
5) _____ I am good at coming up with new ways of solving problems.

Academic Self-Efficacy

1) _____ I'm certain I can master the skills taught in school this year.
2) _____ I can do even the hardest school work if I try.
3) _____ If I have enough time, I can do a good job on all my school work.
4) _____ I can do almost all the work in school if I don't give up.
5) _____ Even if the work in school is hard, I can learn it.
6) _____ I'm certain I can figure out how to do the most difficult school work.

Please rate your responses below on a 1 to 5 scale.

1	**2**	**3**	**4**	**5**
Not at all true of me,		Somewhat true of me		Very true of me

Creative Self-Efficacy

1) _____ I like coming up with new ideas.
2) _____ I have a good imagination.
3) _____ I have a lot of new ideas.
4) _____ I am good at coming up with my own creative projects.
5) _____ I am good at coming up with new ways of solving problems.

Academic Self-Efficacy

1) _____ I'm certain I can master the skills taught in school this year.
2) _____ I can do even the hardest school work if I try.
3) _____ If I have enough time, I can do a good job on all my school work.
4) _____ I can do almost all the work in school if I don't give up.
5) _____ Even if the work in school is hard, I can learn it.
6) _____ I'm certain I can figure out how to do the most difficult school work.

Appendix D: Proposed Method**s**

Participants

Participants will consist of 50 students with and without dyslexia in middle school (25 in each group). Students with dyslexia (the clinical group) will be matched by age, gender, and Oral Language Index (OLI) from the Kaufman Test of Educational Achievement 3rd Edition (KTEA-3; A. S. Kaufman & N. L. Kaufman, 2014) with students that have no history of reading disabilities (the control group). Any student who has been identified by the school as having a language or cognitive impairment will be excluded from the study. Although students with language impairments may not have problems with reading words and spelling, they may have lower oral expression and listening comprehension, which may confound the results of the study. Students with cognitive impairments will be excluded to control for the same reason. All students will be screened with the OLI, and anyone with a standard score below 85 will be excluded to control for language impairments that may be present but not identified. To be in the clinical group, students must be identified with a Specific Learning Disability (SLD) in reading and score below 85 on Sound-Symbol Index (SSI) on the KTEA-3. To be in the control group, students may not be identified with an SLD in reading and score 90 or above on the SSI.

The above criteria were chosen based on the qualitative descriptors provide by A. S. Kaufman, N. L. Kaufman, and Breaux (2014) in the KTEA-3 Technical and Interpretive Manual (Tables 3.2 and 3.3). They provide a 15-point and 10-point classification system. The 15-point system places the cut points on the standard deviation marker. Thus, Average would fall between 115 and 85; Below Average would be 84 to 70. This point system allows for more descriptive information toward the extreme ends of the normal distribution. The 10-point classification system allows for more descriptive information in the middle of the normal curve. Average is considered between 90 and 109, and Below Average is 80 to 89.

Eighty-five was chosen for the cut-off scores for OLI and SSI for the clinical group because it is one standard deviation below the mean and is below the 15th percentile. Students below this score would be struggling. To help distinguish between the control group and the clinical group, a gap was provided between SSI scores so that there was not a student with a score of 84 in the clinical group and one with a score of 85 in the control group. Rather than pick an arbitrary number, z-score, or percentile rank, the 10-point classification system was used for the control group. To be in the control group, students need to get a score of 90 or above. A standard score of 90 is equivalent to the 25th percentile and a standard deviation of -.65.

Measures

Language ability will be measured using five subtests from the KTEA-3: listening comprehension, oral expression, associational fluency, phonological processing, and nonsense word decoding. Visual-spatial ability will be measured with the Visual Puzzles subtest from the Wechsler Intelligence Scales for Children, Fifth Edition (WISC-V; Wechsler, 2014). Four creative products will be assessed using the CAT.

Oral Language Index. Composed of listening comprehension, oral expression, and associational fluency, this index allows for broad understand students' oral language abilities. Internal consistency was derived using the split-half reliability method. The mean coefficient by age for this index is .86.

***Listening comprehension*.** "The student listens to a sentence or a recorded passage, then responds orally to comprehension questions asked by the examiner" (A. S. Kaufman & N L. Kaufman, 2014, p. 5). This subtest contains 68 questions and takes about 14 minutes to

administer for students in grades 6 to 12. Raw scores range from 0 to 27 and are converted to a standard score (M = 100, SD = 15). The mean reliability coefficient is .85.

***Oral expression*.** "The examinee responds orally with a complete sentence to describe each photo. Later items require the use of one or two target words or a beginning" (A. S. Kaufman & N L. Kaufman, 2014, p. 5). This subtest contains 28 questions and takes about 11 minutes to administer for students in grades 6 to 12. Raw scores range from 0 to 46 and are converted to a standard score (M = 100, SD = 15). The mean reliability coefficient is .81.

***Associational fluency*.** "The examinee says as many words as possible in 60 seconds that belong to a given semantic category" (A. S. Kaufman & N L. Kaufman, 2014, p. 5). This subtest contains two trials and takes about three minutes to administer for students in grades 6 to 12. The raw score is the number of correct responses in both trials. This score is converted to a standard score (M = 100, SD = 15). The mean reliability coefficient is .62.

Sound-Symbol Index. Composed of two subtests: phonological processing and nonsense word decoding, this index allows for a broad understanding of students' phonological processing and word decoding ability. The mean reliability for this index is .96.

***Phonological processing*.** "The examinee responds orally to items that require manipulation of the sounds within words" (A. S. Kaufman & N L. Kaufman, 2014, p. 5). This subtest contains 50 questions and takes about 10 minutes to administer for students in grades 6 to 12. Raw scores range from 0 to 15 and are converted to a standard score (M = 100, SD = 15). The mean reliability coefficient is .93.

***Nonsense word decoding*.** "The examinee reads nonsense words" (A. S. Kaufman & N L. Kaufman, 2014, p. 5). This subtest contains 52 questions and takes about 4 minutes to administer for students in grades 6 to 12. Raw scores range from 0 to 52 and are converted to a standard score (M = 100, SD = 15). The mean reliability coefficient is .96.

Visual Puzzles. "Working within a specified time limit, the child views a completed puzzle and selects three response options that when combined reconstruct the puzzle." (Wechsler, 2014, p. 8). This subtest contains 29 questions with a 30 second time limit for each. Raw scores range from 0 to 29 and are converted to scaled scores (M = 10, SD = 3). The mean reliability coefficient is .81.

Creative measures. Four creative products will be measured using the Consensual Assessment Technique (CAT; Amabile, 1996). Students will be asked to think of four imaginary creatures in their heads. They will have 10 minutes to describe one orally, 10 minutes to describe on in writing, 10 minutes to draw one on paper, and 10 minutes to build one with clay. The creatures will each have a made-up name so that students can keep them separate between conditions. The prompts will be provided in writing but also read to them for each condition: I want you to think of four different imaginary creatures. Creatures that you have never seen or heard of before. Create your creatures in your head. These creatures will be named Koh, Zuke, Lops, and Neef. I will ask you to describe one verbally, describe one in writing, draw one, and build one. But you won't know which.

For each product, the following four prompts will be given: Thinking back to the creatures we talked about. Oral: Using this tape recorder, I want you to describe how _____ would look like. Use as much detail as possible. Be as creative as you want, you are able to have fun with this. Writing: I want you to describe in writing how _____ would look. Use as much detail as possible. Don't worry about spelling, but feel free to ask how to spell something. If you like, we can go over any spelling questions after. Be as creative as you want, you are able to have fun with this. Drawing: Using the paper and color pencils provide, I want you to draw what

_____ would look like. Use as much detail as possible. Don't worry about drawing ability, just try your best. Be as creative as you want, you are able to have fun with this. Building: Using the material provide, I want you to build what _____ would look like. Use as much detail as possible. Don't worry about building ability, just try your best. Be as creative as you want, you are able to have fun with this. The names will be assigned to the prompt in a counterbalanced way so that, if one names inspires more creativity it will be found in each condition. The order of the prompts will also be counterbalanced.

The four tasks will be scored for creativity by all raters based on their personal definition of creativity; no additional guidance, descriptors, or material on creativity will be provided. This format is consistent with Amabile's (1996) CAT method. The raters will be assigning scores on a Likert scale from 1 (*not at all creative*) to 6 (*extremely creative*). A creative score for each domain will be derived by averaging the scores from all the raters for that domain. Thus, each student will have an Oral Creative Score, a Written Creative Score, a Drawn Creative Score, and a Built Creative Score. As J. C. Kaufman and Baer (2012) mentioned, quasi-experts can be used as raters. These are people with a certain degree of expertise in the domain being studied. Raters will be recruited from the areas of, Psychology, Education, and Creativity. Past research using the CAT has shown interrater reliability as high as .8 to .99 (Baer et al., 2004; Dollinger & Shafran, 2005; J. C. Kaufman et al., 2013; J. C. Kaufman et al., 2007).

Procedures

Middle schools in Connecticut will be asked if they would like to participate in the research study. Students, along with their parents, will be asked to sign an informed consent to participate in the study. There will be targeted recruitment and follow-up for students with identified reading disabilities. A brief record review will be conducted for those students who returned a signed informed consent to identify if they have any educational disabilities. Any students identified with a language or cognitive impairment will be excluded.

The remaining students who give consent will be given five subtests from the KTEA-3: three of them to get their OLI and two to get their SSI. Those with a score below 85 on the OLI will be excluded, along with those who fall between a score of 85 and 89 on the SSI. The remaining students will be matched by age, sex, and OLI. Any students that are not matched will be held as a backup in case they are needed. All students that are screened will receive a thank you gift for participating in the first round.

For the second round of the study, the students will be given the four creative measures along with the Visual Puzzles subtest. Students will have 10 minutes to describe something creative, 10 minutes to write something creative, 10 minutes to draw something creative, and 10 minutes to build something creative. Students will be given each condition in random order. The subtests will be given at the end to avoid the risk of putting students in a negative mood during the creative measures (e.g., feeling bad or anxious due to performance in the spelling or reading test).

For the writing condition, all students will be informed that spelling does not matter. Written products will be transcribed and edited (for spelling only) before being sent to the raters. The oral creative products will be sent to raters as they are in audio format. Drawings will be scanned, and the built products will be video recorded. Recordings of the built products will be done in the same manner for each. Using a spin wheel, the product will be placed in the center and rotated 360 degrees for the same amount of time and form the same angle. All the creative products will have an ID number. For example, if the student's ID number is 025, their written product would be 025W, their drawing would be 025D, and building would be 025B.

The creative products will be emailed to the raters so that they can rate the products. Raters will not know which group the students belong to. The raters will be graduate students in creativity, education, and or researchers that have done work in creativity.

Data analysis

The study will consist of a 2x4 quasi-experimental design to analyze creativity by group (2) and domain (4). Group will be a between-subject measure with clinical versus control, and domain will be a within-subject measure looking at oral, writing, drawing, and building. Planned comparisons will be used to compare groups within each of the four domains (RQ1; 4 comparisons). The second set of planned comparisons will be used to compare each of the four domains with each other within the clinical group (RQ2; 6 comparisons). A final planned comparison will be used to compare each of the four domains with each other within the control group (RQ3; 6 comparisons).

Family-wise alpha level equals .05. Due to a total of 16 planned comparisons, additional probability test will require a significance level of .003 to achieve the family-wise alpha level of .05 based on the Bonferroni correction. Power analysis using G*Power 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007) indicated the need for 44 participants for a beta of .85. Power Analysis was run using an ANOVA: Repeated Measures, within-between interaction with two groups, and four measurements.

Descriptive statistics will be used to show the difference between the two groups on all assessments, and inter-rater reliability will be derived for each creative measure.

Matching. As mentioned above, age, gender, and OLI will be used to match the clinical group with the control group. While the goal is to have a perfect match for all students, that is unlikely, and thus an order of importance was created. The first variable to match will be gender, as it is binary. OLI is the second variable to be matched as it is the measure that matches students on a cognitive level and is likely most equivalent to academic and creative products. Students will be matched with someone who is within five standard score points. Finally, students will be matched with someone that is less than a year away from them. While this is the ideal matching system, this may change based on the data collected and the students who participate. T-test will be run on the three variables to make sure that the groups are equivalent.

Counterbalancing. The order that the conditions will be presented will be counterbalanced so that there is not a practice effect on the creative tasks. The name of each creature for each domain will also be counterbalanced to prevent a name that possibly encourages more creativity to be linked to a specific domain. The counterbalanced was created by coming up with each combination of four variables 1 (oral), 2 (written), 3(drawn), and 4 (built). This resulted in 24 combinations. These combinations were entered into an Excel file five times and proved a random number. The random numbers were sorted in ascending order to randomize the combinations. The same process was done for creature name, and the two combinations were paired with each other. The participant gets the drawing condition first, and the creature's name will be (B), followed by the written condition with (C) as the creature's name than D will be built, and finally, A will be described orally.

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Appendix E: Consent Form

Parental Permission Form for Participation in a Research Study

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Principal Investigator: Melissa Bray (Ph.D., School Psychology)
Student Researcher: Maria J. Avitia (Doctoral Candidate, School Psychology)
Study Title: Differences in Creativity across domains between students with dyslexia and those without

Introduction

Your child is invited to participate in a research study to identify strengths in the area of creativity. Students with dyslexia and those without will be assessed on various language and reading measures for grouping purposes. Once groups are identified, students will then produce four creative products that will be compared between and within groups. Your child is being asked to participate because he/she is in grades 6-8th in the participating school, or because your child has an identified specific learning disability.

This study is being conducted as a dissertation study by Maria J. Avitia under the supervision of Dr. Melissa Bray, professor of School Psychology at the University of Connecticut-Storrs.

Why is this study being done?

The purpose of this research study is to identify strengths in the area of creativity for students with and without dyslexia. The hope is that by identifying strengths for students with dyslexia we can better understand what these students can do, rather than what they can't. Then we can investigate how these strengths may be used for future interventions.

What are the study procedures? What will my child be asked to do?

There are two levels of the study. A screening will consist of a brief record review/survey to gather basic demographic information (name, age, gender, grade, lunch status, ethnicity, second language), and if your child has a specific educational disability. Students with certain educational disabilities (Specific Language Impairments and Intellectual Disabilities) will be excluded from the study.

To be in the dyslexia group, students need to have a specific learning disability in reading or have a diagnosis of dyslexia. To be in the non-dyslexia group, students can not have a history of word reading difficulties. It is expected to have more students in the non-dyslexia group than the dyslexia group. Thus, only those who are able to be matched to a student in the dyslexia group will proceed on to the study phase. If multiple students without dyslexia match with a specific student who has dyslexia, one will be randomly assigned to a match and the other will be kept as a backup, in case the first student is unable to continue in the study.

If your child is matched with a student from the other group they will be seen once again and asked to create 4 creative products: one oral, one written, one drawn, and one built. They will also do one more subtest, to measure visual spatial abilities. This session will take about 45-50 minutes to complete. Your child will be given breaks as needed. Before and after the session, students will also answer questions about how he/she views their own creative and academic ability.

You will have the chance to choose if your child will be seen during school hours, after school or during the weekend in a designated setting. If you would like your child to participate outside of school hours, you will have to coordinate with the student researcher to find an appropriate time and place for assessment. The screening part of the study will start on _____. Based on the screening, the study will take place within the month. The screening survey takes about 5 minutes to complete and will be done online by the school or the parent. The study will take about 45-50 minutes for the student to complete.

As mentioned above, one of the conditions will consist of an oral creative product. For this creative product, students will share their creative product on an audio recording. This audio will only be used for scoring purposes, and will not be shared with anyone outside of the research team.

If your child agrees to be a part of the study, he/she will also need to sign the permission form at the end of this packet. However, before starting the assessment, your child will be asked to give assent once again just to make sure he or she is willing to participate. It will be explained to your child that their participation is voluntary and they can stop at any time. However, your child may be withdrawn from the study due to noncompliance, or behavioral difficulties.

What are the risks or inconveniences of the study?

There are no known risks for participating in this study greater than what your child typically experiences in an everyday school setting. If your child gets tired during testing, they will be provided with breaks.

There are some inconveniences involved in participating in the study. If the session is conducted during school hours, then your child will miss about an hour of class time. To reduce this risk, students will not be pulled from their academic or support classes. If the session is done outside of the school setting, then parents or guardians will need to coordinate with the student investigator to set up a time and location.

Finally, Breach of Confidentiality is always a risk. To protect from that, your child's data will be saved on a secure UCONN server which will be password protected. Only the PI and Student Researcher will have access to it. For a more secure measure, your child's name will not be stored on the server with the data.

What are the benefits of the study?

Your child may not directly benefit from this research; however, we hope that your child's participation in the study may help us identify strengths for students with dyslexia which may later be used to create strengths-based interventions.

Will my child receive payment for participation? Are there costs to participate?

There are no costs to you and your child for participating in this study. Your child will receive a gift that will consist of fun school supplies after completing all the measures. If your child withdrawals from the study or has to be let go from the study due to noncompliance, they will not receive the gift.

How will my child's information be protected?

The following procedures will be used to protect the confidentiality of the data collected from your child. The researchers will keep all study records (including any codes to your child's data) locked in a secure location. Research records will be labeled with a code. The code will be derived using a random number generator to create a 3-digit ID. A master key that links names and codes will be maintained in a separate and secure location. The master key and audio recordings will be destroyed after 3 years. Deidentified data will be kept indefinitely. All electronic files (e.g., database, spreadsheet, etc.) containing identifiable information will be password protected. Any computer hosting such files will also have password protection to prevent access by unauthorized users. Only the members of the research team will have access to the passwords. Data that will be shared with others will be coded as described above to help protect your child's identity. At the conclusion of this study, the researchers may publish their findings. Information will be presented in summary format, and your child will not be identified in any publications or presentations.

We will do our best to protect the confidentiality of the information we gather from your child, but we cannot guarantee 100% confidentiality. Your child's confidentiality will be maintained to the degree permitted by the technology used. Specifically, no guarantees can be made regarding the interception of data sent via the Internet by any third parties.

If during the course of this research study, a UConn employee suspects that a minor (under the age of 18) has been abused, neglected, or placed at imminent risk of serious harm, it will be reported directly to the Department of Children and Families (DCF) or a law enforcement agency.

You should also know that the UConn Institutional Review Board (IRB) and Research Compliance Services may inspect study records as part of its auditing program, but these reviews will only focus on the researchers and not on your child's responses or involvement. The IRB is a group of people who review research studies to protect the rights and welfare of research participants.

Can my child stop being in the study and what are my and my child's rights?

Your child does not have to be in this study if you do not want him/her to participate. If you give permission for your child to be in the study, but later change your mind, you may withdraw your child at any time by contacting the principle investigator or student researcher. There are no penalties or consequences of any kind if you decide that you do not want your child to participate. If your child decides that he or she does not want to be in or continue to be in the study, he or she just needs to inform the student researchers when they are seen.

As mentioned above your child may be removed from the study due to too many missed appointments, non-adherence to procedures, disruptive behavior, and or adverse reactions.

Whom do I contact if I have questions about the study?

Take as long as you like before you make a decision. We will be happy to answer any questions you have about this study. If you have further questions about this study or if you have a research-related problem, you may contact the student researcher Maria Avitia (909) 997-5798. If you have any questions concerning your child's rights as a research participant, you may contact the University of Connecticut Institutional Review Board (IRB) at 860-486-8802.

Thank you,

Melissa Bray

Professor of School Psychology

Department of Educational Psychology

Email: melissa.bray@uconn.edu

Parental Permission Form for Participation in a Research Study

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Return Slip

Principal Investigator: Melissa Bray (Ph.D., School Psychology)
Student Researcher: Maria J. Avitia (Doctoral Candidate, School Psychology)
Study Title: Differences in creativity across domains between students with dyslexia and those without.

Documentation of Permission:

I have read and understand the general purposes of the study, and the particulars of my child's involvement. The possible risks and inconveniences have been explained to my satisfaction. I understand that I can withdraw my child at any time during the study. My signature also indicates that I have received a copy of this parental permission form.

Please return this form to the child's teacher by _____.

Based on this information, I have decided to:

_____Give permission for my child to participate in this study.

_____	_____	_____
Child Signature:	Print Name:	Date:
_____	_____	_____
Parent/Guardian Signature:	Print Name:	Date:

Relationship to Child (e.g. mother, father, guardian): _____

Location of testing: To allow for flexibility, please indicate all the times and locations you are willing to have your child participate in the study. Only circle those you can commit to. For options 2, please provide your phone number for scheduling purposes.

1) At School	2) In another Setting	
During school hours	After school or during the weekend	Phone # _____

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Research Study Photo/Video Release Form

Protocol #_ H17-096___ Principal Investigator: _Dr. Melissa Bray___

Protocol Title: _ Differences in creativity across domains between students with dyslexia and those without__

As part of this research study the University of Connecticut and those acting pursuant to its authority ("UCONN") may record your likeness and/or voice on a particular medium ("recordings") including but not limited to video, audio, photographic, digital, and electronic mediums during your participation in this research study. Please indicate what uses of these recordings you are willing to permit, by putting your initials next to the uses you agree to and signing the form at the end. The choice is completely up to you. We will only use recordings in the ways that you agree to. In any recording, you will not be identified by name. The photo/videos will not be used for commercial purposes.

1._____ The recordings can be studied by the research team for use in the research project

2._____ The recordings can be used for scientific publications

3._____ The recordings can be used for scientific conferences or meetings

4._____ The recordings can be used for educational purposes

I understand that all such recordings, in whatever medium, shall remain the property of UCONN. My name will not be used in any publication. I agree that I will not be compensated for the use of the recordings.

I have read the above descriptions and give my consent for the use of the recordings as indicated by my initials above. **(Youth under 18 years of age must have a parent/legal guardian signature.)**

_____
(Name, please print)

_____ _____
(Signature of Student) (Date : MM/DD/YY)

_____ _____
(Parent/Guardian Signature, if participant is a minor) (Date : MM/DD/YY)

Project Title: Differences in creativity across domains between students with dyslexia and those without

Researcher: Ms. M. J. Avitia

Your parents have talked to you about being in a research study. Dr. Bray and her student researcher want to learn more about creativity and how students with dyslexia and those without are different. You can ask as many questions as you like about the study and Dr. Bray or her student researcher will explain it to you in a way that you can understand.

First, you will answer some questions about your abilities, then you will do 4 creative things, tell a story, describe something in writing, draw something, and build something with clay. Finally answer some puzzle questions.

You may call Dr. Bray or her student researcher, or ask your parent to call for you, at any time if you have more questions about the study. You don't have to be in this study if you don't want to and no one will be mad at you. If at first you say yes, but later change your mind, you should let your parents or Dr. Bray's student researcher know, and you won't have to be in the study anymore.

This information sheet is yours to keep.

UCONN IRB PROTOCOL H17-096 APPROVED 6/5/18